

CLAIMS

1. An image pickup apparatus comprising:
 - a shaking motion detecting section for detecting a shaking motion of the image pickup apparatus and for outputting a shaking motion detection signal indicating the shaking motion of the image pickup apparatus;
 - an image forming section for forming an optical image by focusing light incident to the image pickup apparatus;
 - an image pickup section for converting the optical image formed by the image forming section into electric video information; and
 - a locus calculating section for obtaining locus information indicating a locus of the shaking motion of the image pickup apparatus based on at least the shaking motion detection signal output from the shaking motion detecting section.
2. An image pickup apparatus according to claim 1, wherein
 - the locus calculating section obtains, as the locus information, information indicating a change in the shaking motion detection signal during a predetermined period of time.
3. An image pickup apparatus according to claim 1, wherein
 - the shaking motion detecting section includes an angle velocity sensor, and
 - the locus calculating section obtains angle information by integrating an output from the angle velocity sensor, and obtains, as the locus information, information indicating a change in the angle information during a predetermined period of time.

4. An image pickup apparatus according to claim 3, wherein
the angle velocity sensor is a vibration gyroscope having a plurality of
vibration frequencies which are different from each other.
5. An image pickup apparatus according to claim 1, wherein
the locus calculating section obtains, as the locus information, information
indicating a locus weighted by the shaking motion of the image pickup apparatus.
6. An image pickup apparatus according to claim 1, wherein
the locus calculating section obtains, as the locus information, a point spread
function PSF.
7. An image pickup apparatus according to claim 5, wherein
the locus calculating section determines whether or not an amount of
temporal change in the shaking motion of the image pickup apparatus is larger than
a predetermined threshold value, and determines a number of samples in
accordance with the determination result.
8. An image pickup apparatus according to claim 1, further comprising:
an output section for generating data in an Exif format by adding the locus
information to the video in-format, and for outputting the data in the Exif format.
9. An image pickup apparatus according to claim 1, wherein
the locus calculating section obtains the locus information based on at least
focus information, zoom information, and the shaking motion detection signal.
10. An image pickup apparatus according to claim 1, further comprising:
an electronic shaking motion correcting section for performing a calculation
processing on the locus information and the video information, so as to obtain

corrected video information which is subjected to the correction of the shaking motion.

11. An image pickup apparatus according to claim 10, wherein
the electronic shaking motion correcting section determines whether or not the shaking motion detection signal is larger than a predetermined threshold value, and

when it is determined that the shaking motion detection signal is larger than the predetermined threshold value, the electronic shaking motion correcting section does not correct the shaking motion in the video information.

12. An image pickup apparatus according to claim 10, wherein
the calculation processing includes a Fourier transform, a Fourier inverse transform, or a processing using a two-dimensional filter.

13. An image pickup apparatus according to claim 10, wherein
the locus information includes a locus function h , and
the calculation processing includes a calculation of a Fourier transform of h or a calculation using a result of the Fourier transform of h , or
the calculation processing includes a calculation of a Fourier inverse transform which is a reciprocal of the Fourier transform of h or a calculation using a result of the Fourier inverse transform which is the reciprocal of the Fourier transform of h .

14. An image pickup apparatus according to claim 10, further comprising:
a processing amount calculating section for calculating a calculation processing amount required for correcting the shaking motion in the video information.

15. An image pickup apparatus according to claim 14, wherein
when the calculation processing amount or a shaking motion amount
exceeds a predetermined value, a display indicating an exceeding situation is made
on a display section and/or a sound indicating an exceeding situation is generated
from a speaker.
16. An image pickup apparatus according to claim 14, wherein
when the calculation processing amount exceeds a predetermined value, the
video information which is not subjected to the correction of the shaking motion is
output, and
when the calculation processing amount is within a predetermined range,
corrected video information which is subjected to the correction of the shaking
motion in the video information is output.
17. An image pickup apparatus according to claim 10, wherein
at a specific time after displaying the video information on a display section,
the corrected video information is displayed on the display section.
18. An image pickup apparatus according to claim 17, wherein
time at which the calculation processing for the correction of the shaking
motion in the electronic shaking motion correcting section is completed is used as
the specific time.
19. An image pickup apparatus according to claim 10, further comprising:
a maximum shaking motion amount calculating section for receiving the
corrected video information from the shaking motion correcting section, and for
calculating a maximum shaking motion amount of the shaking motion in each
direction; and

a trimming section for trimming the corrected video information in accordance with the maximum shaking motion amount, so as to generate trimmed corrected video information.

20. An image pickup apparatus according to claim 19, further comprising:
a setting section capable of setting a first trimming mode or a second trimming mode, wherein

in the first trimming mode, the trimming section trims the corrected video information in accordance with the maximum shaking motion amount, so as to generate a first trimmed corrected video information, and

in the second trimming mode, the trimming section trims the first trimmed corrected video information, as a center of a pixel corresponding to a center pixel of the first trimmed corrected video information, so as to generate a second trimmed corrected video information, the center pixel being a pixel located at a center of the video information in each direction.

21. An image pickup apparatus according to claim 1, further comprising:
a mechanical shaking motion correcting section for mechanically correcting the shaking motion of the image pickup apparatus in accordance with the shaking motion detection signal, so as to obtain corrected video information which is subjected to the correction of the shaking motion in the video information by an actual shaking motion correction amount, wherein

the locus calculating section obtains, as the locus information, information indicating a change during a predetermined period of time in a difference between the shaking motion detection signal and the actual shaking motion correction amount.

22. An image pickup apparatus according to claim 21, wherein the locus information is in an Exif format.
23. An image pickup apparatus according to claim 21, wherein the mechanical shaking motion correcting section mechanically corrects the shaking motion of the image pickup apparatus in accordance with the shaking motion detection signal, so as to obtain a first corrected video information which is subjected to the correction of the shaking motion in the video information by a first shaking motion correction amount,
- the locus calculating section obtains, as the locus information, information indicating a change in a remaining shaking motion amount during a predetermined period of time, the remaining shaking motion amount indicating a difference between the actual shaking motion correction amount and the first shaking motion correction amount, and
- the image pickup apparatus further comprises:
- an electronic shaking motion correcting section for performing a calculation processing on the locus information and the first corrected video information, so as to obtain a second corrected video information which is subjected to the correction of the shaking motion in the first corrected video information by a second shaking motion correction amount.
24. An image pickup apparatus according to claim 23, wherein the calculation processing includes a Fourier transform, a Fourier inverse transform, or a processing using a two-dimensional filter.
25. An image pickup apparatus according to claim 23, wherein the locus information includes a locus function h , and

the calculation processing includes a calculation of a Fourier transform of h or a calculation using a result of the Fourier transform of h , or

the calculation processing includes a calculation of a Fourier inverse transform which is a reciprocal of the Fourier transform of h or a calculation using a result of the Fourier inverse transform which is the reciprocal of the Fourier transform of h .

26. An image pickup apparatus according to claim 21, wherein
the mechanical shaking motion correcting section calculates the first shaking motion correction amount based on positional information of a lens which is a part of the image forming section.

27. An image pickup apparatus according to claim 21, wherein
the mechanical shaking motion correcting section calculates the first shaking motion correction amount based on the shaking motion detection signal and a shaking motion control characteristic of the mechanical shaking motion correcting section.

28. An image pickup apparatus according to claim 1, wherein
the shaking motion detecting section includes: a first shaking motion detecting section for detecting a shaking motion in a pitch direction and a shaking motion in a yaw direction among the shaking motions of the image pickup apparatus; and a second shaking motion detecting section for detecting a shaking motion in a roll direction among the shaking motions of the image pickup apparatus,
the locus calculating section obtains, as the locus information, information indicating a change during a predetermined period of time in a detection signal output from the second shaking motion detecting section, and

the image pickup apparatus further comprises:

a mechanical shaking motion correcting section for obtaining a first corrected video information which is subjected to the correction of the shaking motion in the pitch direction and the correction of the shaking motion in the yaw direction in accordance with a detection signal output from the first shaking motion detecting section.

29. An image pickup apparatus according to claim 28, further comprising:
a section for adding the locus information to the corrected video information for output, or for recording the locus information onto a recording medium.
30. An image pickup apparatus according to claim 29, wherein
the locus information is in an Exif format or a format similar to the Exif format.
31. An image pickup apparatus according to claim 28, further comprising:
an electronic shaking motion correcting section for obtaining a second corrected video information, which is subjected to the correction of the shaking motion in the first corrected video information, by performing a calculation processing on locus information in the roll direction and the first corrected video information.
32. An image pickup apparatus according to claim 31, wherein
the calculation processing includes a Fourier transform, a Fourier inverse transform, or a processing using a two-dimensional filter.
33. An image pickup apparatus according to claim 31, wherein
the locus information includes a locus function h , and

the calculation processing includes a calculation of a Fourier transform of h or a calculation using a result of the Fourier transform of h , or

the calculation processing includes a calculation of a Fourier inverse transform which is a reciprocal of the Fourier transform of h or a calculation using a result of the Fourier inverse transform which is the reciprocal of the Fourier transform of h .

34. A product package comprising an image pickup apparatus and a recording medium, wherein

the image pickup apparatus includes:

a shaking motion detecting section for detecting a shaking motion of the image pickup apparatus and for outputting a shaking motion detection signal indicating the shaking motion of the image pickup apparatus;

an image forming section for forming an optical image by focusing light incident to the image pickup apparatus;

an image pickup section for converting the optical image formed by the image forming section into electric video information;

a locus calculating section for obtaining locus information indicating a locus of the shaking motion of the image pickup apparatus based on at least the shaking motion detection signal output from the shaking motion detecting section; and

an outputting section for adding the locus information to the video information to output image information, and

the recording medium has a program recorded therein, the program is for causing a computer to execute a processing, the processing includes:

receiving the image information;

separating the image information into the locus information and the video information; and

obtaining corrected video information, which is subjected to the correction of the shaking motion in the video information, by performing a calculation processing on the locus information and the video information.

35. A product package according to claim 34, wherein the locus information is in an Exif format.

36. A product package according to claim 34, wherein the calculation processing includes a Fourier transform, a Fourier inverse transform, or a processing using a two-dimensional filter.

37. A product package according to claim 34, wherein the locus information includes a locus function h , and the calculation processing includes a calculation of a Fourier transform of h or a calculation using a result of the Fourier transform of h , or the calculation processing includes a calculation of a Fourier inverse transform which is a reciprocal of the Fourier transform of h or a calculation using a result of the Fourier inverse transform which is the reciprocal of the Fourier transform of h .

38. A product package according to claim 34, wherein the locus information is a weighted locus or a point spread function.

39. A product package comprising an image pickup apparatus and a recording medium, wherein

the image pickup apparatus includes:

a shaking motion detecting section for detecting a shaking motion of the image pickup apparatus and for outputting a shaking motion detection signal indicating the shaking motion of the image pickup apparatus;

an image forming section for forming an optical image by focusing light incident to the image pickup apparatus;

an image pickup section for converting the optical image formed by the image forming section into electric video information;

a locus calculating section for obtaining locus information indicating a locus of the shaking motion of the image pickup apparatus based on at least the shaking motion detection signal output from the shaking motion detecting section;

a mechanical shaking motion correcting section for mechanically correcting the shaking motion of the image pickup apparatus in accordance with the shaking motion detection signal, so as to obtain corrected video information which is subjected to the correction of the shaking motion in the video information by an actual shaking motion correction amount; and

an outputting section for adding the locus information to the video information to output image information,

the locus calculating section obtains, as the locus information, information indicating a change during a predetermined period of time in a difference between the shaking motion detection signal and the actual shaking motion correction amount, and

the recording medium has a program recorded therein, the program is for causing a computer to execute a processing, the processing includes:

receiving the image information;

separating the image information into the locus information and the video information; and

obtaining corrected video information which is subjected to the correction of the shaking motion in the video information, by performing a calculation processing on the locus information and the video information.

40. A product package according to claim 39, wherein the locus information is in an Exif format.

41. A product package according to claim 39, wherein the calculation processing includes a Fourier transform, a Fourier inverse transform, or a processing using a two-dimensional filter.

42. A product package according to claim 39, wherein the locus information is a weighted locus or a point spread function.

43. A semiconductor integrated circuit comprising:
a locus calculating section for obtaining locus information indicating a locus of a shaking motion of an image pickup apparatus based on at least a shaking motion detection signal output from a shaking motion detecting section for detecting the shaking motion of the image pickup apparatus.

44. A semiconductor integrated circuit according to claim 43, further comprising:
an electronic shaking motion correcting section for obtaining corrected video information which is subjected to the correction of the shaking motion in the video information, by performing a calculation processing on the locus information and the video information.

45. A semiconductor integrated circuit according to claim 43, further comprising:
a mechanical shaking motion correcting section for mechanically correcting the shaking motion of the image pickup apparatus in accordance with the shaking motion detection signal, so as to obtain corrected video information which is subjected to the correction of the shaking motion in the video information by an actual shaking motion amount, wherein

the locus calculating section obtains, as the locus information, information indicating a change during a predetermined period of time in a difference between the shaking motion detection signal and the actual shaking motion correction amount.

46. A semiconductor integrated circuit according to claim 43, wherein
the shaking motion detecting section includes: a first shaking motion detecting section for detecting a shaking motion in a pitch direction and a shaking motion in a yaw direction among the shaking motions of the image pickup apparatus; and a second shaking motion detecting section for detecting a shaking motion in a roll direction among the shaking motions of the image pickup apparatus,

the locus calculating section obtains, as the locus information, information indicating a change during a predetermined period of time in a detection signal output from the second shaking motion detecting section, and

the semiconductor integrated circuit further comprises:

a mechanical shaking motion correcting section for obtaining a first corrected video information which is subjected to the correction of the shaking motion in the pitch direction and the correction of the shaking motion in the yaw direction in accordance with a detection signal output from the first shaking motion detecting section.